REMARKS

In the Office Action, the Examiner rejected claims 1-4, 7-8 and 10-11 pursuant to 35 U.S.C. § 103(a) as being unpatentable over Napolitano (U.S. Patent No. 6,132,375) in view of Freiburger et al. (U.S. Patent No. 6,733,453), and further in view of Alexandru et al. (U.S. Patent No. 6,821,251). Applicants respectfully request reconsideration of the rejections of claims 1-4, 7-8 and 10-11, including independent claims 1 and 10.

Independent claim 1 recites forming a beam across a synthetic elevation aperture where the forming is a broadband process and generating a three-dimensional representation as a function of the beam. Independent claim 10 recites a beamformer operable to form a beam across a synthetic elevation aperture where the forming is a broadband process, and an image processor operable to generate a three-dimensional image as a function of the beam.

Napolitano does not disclose these limitations. Napolitano uses a matched filter in elevation (Col. 6, lines 30-51). The matched filtering is performed in space (see equation 7) or in a spatial frequency domain (see Col. 6, lines 52-60). This matched filtering is described with reference to Napolitano in the current application at paragraph 41. An alternative approach is to use a wideband process, such as beamforming (see paragraph 42 of the current application). The matched filtering of Napolitano is applicable to narrow-band signals. Napolitano does not suggest forming a beam as a broadband process. The point-spread function derived in Eq. (6) of Napolitano is only a good approximation at a single frequency (usually the center frequency), as represented by the variables k and lambda. Hence, the phase correction calculated based on that equation is also only correct for that frequency. The matched filtering described in Eq. (7) which is based on Eq. (6) is also valid only at that frequency, and the Fourier transform approach, which implements the matched filtering in the spatial frequency domain, is also valid only at that frequency.

The Examiner notes on page 3 that Napolitano et al. use delay and sum beamformation in 14. However, the beamformer is for generating two-dimensional scans along azimuth and range dimensions (col. 3, lines 39-53). The beamformed data for a plurality of two-dimensional planes spaced apart in elevation are stored in the beamformer or

the filter (col. 4, lines 39-43). The narrow band matched filtering process is then performed in elevation (col. 4, lines 44-47). Napolitano et al. do not disclose forming a beam across an elevation aperture as a broadband process.

The Examiner cites to Freiburger et al. for use of a broadband transducer for frequency compounding in elevation. Freiburger et al. teach compounding two acquisitions of the same image plane using different sized elevation apertures. This compounds the spatial frequencies, not spectral frequencies. This use of the transducer does not result in the matched filtering process of Napolitano being a broadband process. Furthermore, compounding combines grayscale image data after eliminating the phase information necessary for beamforming. The purpose of compounding is to reduce speckle, but may result in poorer resolution. Forming a beam across a synthetic elevation aperture may improve beam width to improve resolution. Similarly, combining signals associated with different frequencies may provide signals over a greater bandwidth, but not change the matched filtering into a broadband process. Using the broadband transducer of Freiburger et al. with the process of Napolitano still does not provide forming a beam across a synthetic elevation aperture where the forming is a broadband process.

Additionally, a person of ordinary skill in the art would not have used the teachings of Freiburger et al. with Napolitano. Freiburger et al. frequency compound data representing a same scan plane (Col. 5, lines 31-44). Conversely, Napolitano forms a synthetic aperture from overlapping but different elevation scan planes (Col. 4, lines 51-58). As discussed above, these two different processes provide different results. Napolitano seeks greater resolution, but Freiburger et al. sacrifice resolution for speckle reduction. Given the different purposes and corresponding different scan approaches, there is no suggestion to use the teachings of Freiburger et al. with Napolitano.

The Examiner notes Applicants previous argument as the references not teaching beamformation across the synthetic elevational aperture. Beamformation is an example broadband process. Based on the beamformation example, the Examiner further cites to Alexandru et al., alleging "it would have been obvious in view of Alexandru et al. . . . to synthesize a synthetic aperture for elevational beamformation across multiple subapertures." Alexandru et al. use delay, weighting and summing to synthesize a receive aperture (col. 5,

lines 23-26). In one example, azimuthal spacing of the sub-apertures is used (col. 5, lines 7-15), not elevation. In another example, two different apertures have a different elevational extent, but are centered in a same elevational location (Figs. 3 and 4; and col. 5, lines 26-36). Alexandru et al. provide processes for 1.25, 1.5 and 1.75D array imaging (col. 1, lines 50-65). Alexandru et al. provides synthetic aperture to form data for a plane, so does not suggest three-dimensional imaging or representation.

Freiburger et al. frequency compound data representing a same scan plane (Col. 5, lines 31-44), so do not suggest generating a three-dimensional image or representation as a function of the beam.

A person of ordinary skill in the art would not have used the teaching of Alexandru et al. with Napolitano. Napolitano desires refocused or more narrow beams (col. 2, lines 10-12). Refocusing provides higher resolution information (col. 4, lines 59-60) after beamformation (col. 4, lines 39-47). Conversely, Alexandru et al. disclose beamformation for data from two different elevation apertures (col. 5, lines 23-26). Elevation beamformation would not have been used with the teaching of Napolitano since Napolitano teaches synthesizing to narrow, not to form, the beams.

Additionally, it is the narrower beams that are used for three-dimensional imaging by Napolitano (col. 3, lines 8-10; and col. 8, lines 1-7). Alexandru et al. teaches delay and sum across elevation for two-dimensional imaging. The beamformation across elevation of Alexandru et al. to a two-dimensional azimuth, range plane would deny the process of Napolitano the elevationally spaced information used for narrowing the data. Alexandru et al. provides processes for two-dimensional imaging. A person of ordinary skill in the art would not have used the two-dimensional elevation beamformation of Alexandru et al. with the teachings of Napolitano since beamforming into a two-dimensional azimuth, range plane results in a lack of elevation spaced planes for filtering and three-dimensional imaging by Napolitano.

The dependent claims 2-4, 7 and 11 are allowable for the same reasons as the independent claims from which they depend. Further limitations distinguish from Freiburger

et al., Napolitano and Alexandru et al. Clams 3 and 4 further recite spatial considerations not suggested by cited references.

Independent claim 8 requires forming the beam from beamformed data. Napolitano narrows the beam, not forms the beam as a broadband process. Freiburger et al. compounds detected data (col. 4, lines 61-67), not forms the beam. Alexandru et al. do not form a beam from beamformed data.

New claim 35 recites forming a plurality of different elevationally spaced beams across a synthetic elevation aperture as a function of the first and second sets of ultrasound data, the forming being a broadband process. Napolitano does not form the beam as a broadband process. Freiburger et al. compounds detected data, not forming the beam. Alexandru et al. form a beam for the elevation aperture, not a plurality of elevationally spaced beams.

CONCLUSION:

Applicants respectfully submit that all of the pending claims are in condition for allowance and seeks early allowance thereof. If for any reason, the Examiner is unable to allow the application but believes that an interview would be helpful to resolve any issues, he is respectfully requested to call the undersigned at (650) 694-5810 or Craig Summerfield at (312) 321-4726.

PLEASE MAIL CORRESPONDENCE TO:

Siemens Corporation
Customer No. 28524
Attn: Elsa Keller, Legal Administrator
170 Wood Avenue South
Iselin, NJ 08830

Respectfully submitted,

Jenny G. Ko, Reg. No. 44,190
Attorney(s) for Applicant(s)
Telephone: (650) 694-5810
Date: 3/31/06